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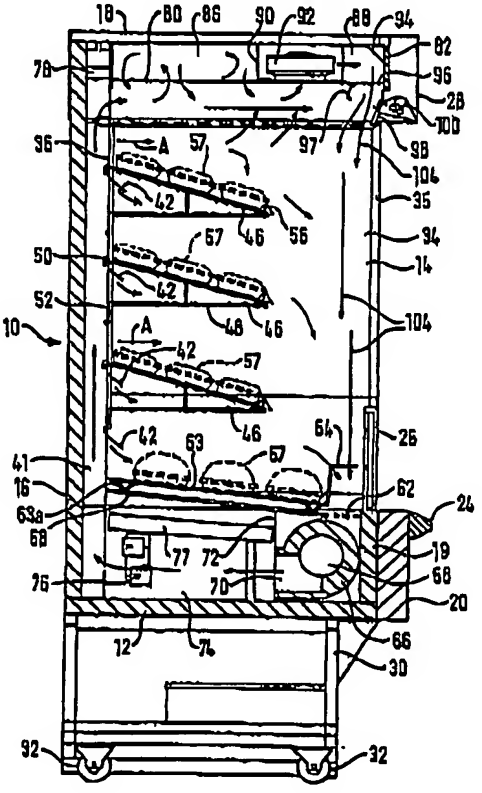
(54) Title: A HEATED FOOD STORAGE AND DISPLAY CABINET

(57) Abstract

A heated food storage and display cabinet (10) comprises an open fronted enclosed chamber (34) in which packs of food (57) can be stored. An upwardly extending enclosed air duct (41) has a plurality of outlets over a substantial length of the duct leading from the duct to the chamber and first flow inducing means (66) for directing air upwardly through the duct and second flow inducing means (92) for producing a curtain (104) of air which is directed across the open front (35) of the chamber (34). The first flow inducing means (66) causes the air to pass over heater means (76), through the duct (41) passing through the outlets and into the chamber. The second flow inducing means (92) is arranged to draw air from the upper end of the chamber and use it in the formation of an air curtain across the open front (35) of the chamber (34).



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A HEATED FOOD STORAGE AND DISPLAY CABINET

The invention relates to a heated food storage and display cabinet and is primarily concerned with a heated food storage and display cabinet for use in supermarkets.

Changes in working patterns have led to changes in eating habits particularly with respect to what might be called the traditional evening meal where a family sits around a table and eats home-cooked food. It is now becoming increasingly commonplace for convenience meals to be eaten in the evening while watching television from an easy chair. That has, in turn, led to an increase in take-away food outlets where a person can collect a hot ready- cooked meal to eat at home. For some time, supermarkets have offered a range of prepared food which can be taken home, heated or cooked, and then eaten. However, there is now increasing competition from take-away food outlets which supermarkets would like to address by supplying hot ready-cooked meals themselves. One of the problems faced by supermarkets is how to keep such food hot whilst making it readily accessible to customers and an object of the present invention is to provide a cabinet which will be suitable for such a purpose.

In US-A-3,942,426 there is described a heated sandwich bin with air curtains. The bin is not intended for display of packaged heated food which customers select and take away but is intended for use by fast food outlets where sandwiches need to be kept hot without spoiling so that those who are serving food to a customer can do so quickly. The bin has heated air curtains at front and rear ends open. Whilst some of the air diffuses inwardly of the bin, the air does not actually flow over the sandwiches themselves to avoid drying them out. One object of the present invention is to provided a heated food storage cabinet which enables air to flow over packs of food.

Attempts have been made to provide open fronted refrigerated food display cabinets which use an air curtains to help prevent cooled air escaping through the open front. Whilst the present invention is not concerned with food refrigeration, examples of

refrigerated cabinets can be seen in US-A-2,993,349 and US-A-5,755,108. In US-A-2,993,349, an open fronted refrigerated display cabinet has an upwardly open-fronted flue at its rear and a blower for moving air over a refrigerating unit and upwardly through the flue. A second blower is provided at the upper end of the cabinet which draws air upwards through the flue and directs it downwards as a curtain across the open front of the cabinet and towards an air inlet at the bottom of the cabinet for recirculation. The open front of the flue does not, however, guarantee that a sufficient amount of cooled air will reach the food stored at the top of the cabinet or that the flow of air will be reasonably even throughout. Moreover, any food overhanging the back of the shelves so as to project into the cabinet will interfere with upset the flow of air along the flue. Moreover, a flow path to the second blower does not encourage air to flow over food at the upper end of the cabinet.

US-A-5,755,108 similarly provides an upward flow of cooled air at the rear of the cabinet and a curtain of air across an open front. Whilst in this case the problem of an open fronted flue does not exist, the construction is rather complex. For example, the upward flow of cooled air for circulation within the cabinet relies either upon the way in which air from a single outlet in the base of the cabinet can flow through a gap behind the lowest shelf or it is necessary to provide two completely separate air flow channels at the rear of the cabinet, one exclusively for air to be used as the air curtain and the other exclusively for supplying air for cooling food in the cabinet. In the former case, any food projecting across the gap behind the shelf will upset air flow to the remainder of the cabinet and, in the latter case, the need to provide two air flow channels takes up space thereby decreasing the amount of space available for food storage and makes manufacturing more complex. Moreover, as in US-A-2,993,349, the flow path to a blower at the upper end of the cabinet used to produce the air curtain does not encourage air to flow over food at the upper end of the cabinet.

According to a first aspect of the invention there is provided a heated food storage and display cabinet comprising an open fronted enclosed chamber in which packs of food can be stored, an upwardly extending enclosed air duct having a plurality of outlets over a substantial length of the duct leading from the duct to the chamber, a first flow inducing means for directing air upwardly through the duct and a second flow inducing means for producing a curtain of air which is directed across the open front of the chamber, and heater means, the first flow inducing means causing the air to pass over the heater means, through the duct passing through the outlets and into the chamber and the second flow inducing means being arranged to draw air from the upper end of the chamber and use it in the formation of an air curtain across the open front of the chamber.

According to a second aspect of the invention there is provided a method of storing and displaying heated food in an open fronted cabinet which is closed at its rear end and in which packs of the food can be stored, the method comprising providing an upwardly extending enclosed air duct in the cabinet, inducing a flow of heated air upwardly through the duct and into the chamber through outlets provided over substantially the full length of the duct so as to flow over packs of the heated food and producing a curtain of heated air which is directed across the open front of the chamber, the curtain of air comprising air drawn from the upper end of the chamber.

The flow of air from the outlets provided over a substantial length of the duct provides an even distribution of heated air over food packs which will normally be placed on shelving in the chamber. As the duct is enclosed, there is no likelihood of food packs projecting into the duct and blocking air flow in the duct. Also, as the second flow inducing means draws air at least partly from the upper end of the cabinet, the air moving towards the second flow inducing means will tend to flow over food packs at the upper end which leads to efficient use of the heated air.

Such a cabinet is particularly good for storing hot take-away food as a customer can simply reach through the air curtain directed across the open front, pick up the food,

and then remove the food from the cabinet. The effective use of an air curtain avoids the need to provide a door on the cabinet which needs to be opened and closed and is advantageous in that respect. Also, the use of air to keep the food heated is much better than supporting the food on shelves in the form of hot plates as the heat is more evenly distributed over the food. Also, hot plates require the use of heating elements to keep them hot making them difficult to relocate in a cabinet.

The upper end of the duct may be closed to encourage air to flow through the outlets and into the chamber.

An air collection zone may be provided at the upper end of the chamber in which air may accumulate. Air from the chamber preferably enters the air collection zone through a plurality of apertures. The air may both enter and leave the collection zone via the apertures. The air collection zone provides an accumulation of heated air which can re-enter the chamber and be used by the flow-inducing means in the formation of the air curtain.

The duct is preferably arranged to the rear of the chamber.

The air directed across the front of the chamber is preferably directed towards a collection zone for recirculation. The collection zone preferably comprises a recirculation inlet at the bottom of the chamber. Preferably, a shield is provided for preventing food in the cabinet from blocking the recirculation inlet. The shield may be provided on a shelf positioned at the lower end of the chamber.

Conveniently, the aforesaid heater means may be arranged in a base or lower part of the cabinet. In such a case, the heater means may be arranged immediately upstream of the duct. Similarly, the first flow inducing means may be arranged in a base or lower part of the cabinet. The flow inducing means is preferably arranged upstream of the heater means. Where the aforesaid collection zone is provided, the flow inducing means preferably receives the air from that zone for recirculation.

The duct may be partly defined by a perforated wall, the perforations forming the said outlets. The perforated wall preferably defines a closure wall of the chamber.

Deflection means such as one or more baffles may be provided for controlling flow of air from the outlets into the chamber. Such baffles help to ensure efficient flow of air over food packs in the chamber.

The cabinet may have an openable door to enable food to be placed in the cabinet initially and to enable staff to refill the cabinet. The door may be arranged in a rear wall of the cabinet.

At least part of the aforesaid duct may be arranged in the door and, in such a case, a wall which has the openable door therein may also define part of the duct.

According to a third aspect of the invention there is provided a heated food storage and display cabinet comprising an open fronted enclosed chamber in which packs of food can be stored, an upwardly extending enclosed air duct having a plurality of outlets over a substantial length of the duct leading from the duct to the chamber, a first flow inducing means for directing air upwardly through the duct and a second flow inducing means for producing a curtain of air which is directed across the open front of the chamber and heater means, the first flow inducing means causing the air to pass over the heater means, through the duct, through the outlets and into the chamber. the cabinet having an openable door in which at least part of the said duct is defined, the openable door enabling food packs to be placed in the cabinet other than through the open front.

A cover may be provided for blocking an exposed part of the duct in the wall when the door is open so that air does not blow from the exposed part of the duct on to a person refilling the cabinet. Also, the use of the cover prevents objects accidentally being dropped into the duct when the cabinet is being refilled. The cover may be arranged to block the duct automatically when the door is opened, for example, it may be operated by transmission means such as gearing. The cover may be pivotally

mounted for rotational movement from an open to a closed position as the door is opened. When the door is open, the heating means should be switched off, preferably automatically on opening of the door. Also the first flow inducing means should be switched off when the door is open, preferably automatically on opening of the door. Where the first flow inducing means is switched off when opening the door, the momentum thereof will cause air to continue moving through the duct for a short period. However, the use of the aforesaid cover prevents the air blowing on to the person refilling the cabinet. An audible/visual warning may be provided when the door is opened to remind the staff to close the door after refilling the cabinet.

Shelves are preferably arranged in the chamber for supporting the food. The shelves may be inclined towards the open front for ease of access. For ease of air circulation around the food, the shelving may comprise a mesh or the like. The shelves may be made from or may be coated with a insulative material such as plastics.

Duct means may be provided for ducting the air to the chamber. The duct means may comprise a passageway in a wall of the cabinet, preferably the rear wall thereof. The passageway may have a wall thereof formed by a wall of the chamber, such as the rear wall thereof.

If desired, a refrigeration unit may be arranged adjacent the cabinet, means being provided for directing warm air created by the refrigeration unit into the cabinet, for example to be heated further by the heater means. All of the warm air created by the refrigeration unit may be directed to the cabinet. The heated air from the refrigeration unit may supplement or comprise the air used in the cabinet. In a preferred embodiment, the cabinet and refrigeration unit may be arranged back-to-back. An air flow controller may be arranged to control flow between the refrigeration unit and the cabinet.

A heated food storage and display cabinet in accordance with the invention will now be described by way of example with reference to the accompanying drawings in which:

Fig 1 is a perspective front view of one form of heated food storage and display cabinet in accordance with the invention,

Fig 2 is a vertical cross-section through the cabinet shown in Fig 1 on line II-II in Fig 1,

Fig 3 is a vertical cross section similar to Fig 2 showing another form of heated food storage and display cabinet in accordance with the invention and having an openable door,

Fig 4 is a diagrammatic cross-section showing part of the door in a modified version of Fig 3 and showing a duct cover in an open position when the door is closed and

Fig 5 is a diagrammatic perspective view of the duct cover of Fig 4 showing the way in which it covers the duct when the door is an open position.

A cabinet 10 comprises a bottom wall 12, side walls 14, a rear wall 16 and a top wall 18. The bottom wall 12 supports an upwardly extending front wall 19 and lower front and side panels 20, 22 respectively which carry a rubber bumper 24 to protect against damage by supermarket trolleys. The front wall 19 has a double glazed see-through panel 26 mounted at its upper end. The panel 26 and extends upwardly towards a downwardly extending front canopy panel 28 carried by the top wall 18. The cabinet 10 is mounted on a base 30 having castors 32 for ease of manoeuvring the cabinet into position on the floor, say, of a supermarket.

The cabinet 10 defines a food storage chamber 34 between the walls 12, 14, 16, 18, 19, 20, 22 having and open front 35. A metal skin 36 formed with a multiplicity of

perforations 38 is spaced inwardly of the rear wall 16, the rear wall 16 being imperforate. The skin 36 closes the rear of the chamber 34 and extends widthwise for the full width of the chamber and downwards to the bottom wall 12. The space between the skin 36 and the rear wall 16 forms an air duct 41, the sides of which are closed by the side walls 14. The skin 36 carries vertically spaced baffles 42, the baffles being inclined downwardly, with respect to the skin 36 at a suitable angle, for example 45 degrees. The baffles 42 extend for substantially the full width of the skin 36.

The cabinet has slotted uprights 44 (one only of which is shown in Fig 1) at rear corners of the chamber 34 which support shelving, three shelves 46 being illustrated in the present example. Each shelf 46 has two wire end supports 48. Each wire support 48 is triangular and has spaced apart upper and lower left hand ends 50, 52. The upper end 50 hooks into a selected slot in one of the uprights 44 and the lower end 52 locates in a slot beneath. In that way, each wire support 48 is rigidly located on the uprights 44. A mesh shelf surface 54 is then mounted on the end supports 48. Each mesh shelf surface 54 is provided with an upstanding projection 56 at its front end as shown clearly in Fig 2 to help retain packs 57 of food on the shelves 46 as shown in broken lines. The mesh shelf surfaces 54 are inclined downwardly for ease of access.

The chamber 34 has a inclined floor 58 spaced from the bottom wall 12 of the cabinet. The floor 58 extends between the skin 36 and a position spaced from the top of the front wall 19. A perforated metal sheet 62 extends across the space between the front wall 19 and the floor 58. A shelf 63 having feet 63a stands on the floor 58. The front of the shelf 63 is bent to form an upstanding shield 64 which projects across the perforated metal sheet 62 as is apparent from Fig 2. Suitably mounted in the cabinet 10 beneath the floor 58 is a blower in the form a suitable air pump 66 having an inlet 68 and an outlet 70. The inlet 68 is positioned in front of a divider 72 extending between the side walls 14 and between the bottom wall 12 and floor 58. The outlet 70 directs air into a heating zone 74 to the rear of the divider 72.

Electrical heating elements 76 are carried on a mounting 77 suitably supported in the heating zone 74.

Looking at the upper end of the cabinet 10, the duct 41 has a closure 78 at its upper end and a perforated metal sheet 80 extends from one side wall 14 to the other and from the cross member skin 36 adjacent the closure 78 to a front cross member 82. The front cross member 82 extends between the side walls 14 and may be constructed from an insulating material. An area between the perforated sheet 80 and the wall 18 is divided into two compartments 86, 88 by a sheet metal mounting 90 which carries a blower in the form of a suitable fan 92. A baffle 94 extends between the cross member 82 and wall 18 at an angle of approximately 45 degrees and is intended to direct air towards an outlet 96 extending for the full width of the chamber 34 and formed by one or more apertures such as slots in the metal sheet 80. A guide fin 97 projects downwardly from the sheet 80 adjacent the outlet 96. A further guide fin 98 of translucent material extends downwardly from panel 82 adjacent the outlet 96. The guide fins 97 extend for the full width of the chamber 34 and it will be noted that they are inclined to the vertical and are substantially parallel. A strip light fitting 100 is mounted between the canopy panel 28 and the front cross-member 82 adjacent the guide fin 98. The translucence of the guide fin 98 ensures that the guide fin 98 will not cast a shadow from the light 100 onto food in the chamber.

The operation of the cabinet 10 will now be described.

With electric power switched on to the pump 66, the heating elements 76 and the fan 92, the pump 68 draws air through the front perforated sheet 62 and into the inlet 68. The air is then blown by the pump 66 through the outlet 70, over the heating elements 76, through the perforations 38 in the adjacent part of the perforated skin 36 and into the air duct 41. The heated air is driven upwards through the duct 41 and as the upper end of the duct has the closure 78, the heated air is forced through the perforations 38 in the front skin 36 of the door 26 and into

the chamber 34 as indicated by the arrows A in Fig 2. The baffles 42 help to deflect the heated air downwardly and encourage flow of air around the food packs 57 on the shelves 46, 63. The operation of the fan 92 draws some of the air near the top of the chamber 34 upwards (thereby encouraging air flow at the top of the chamber beneficial for maintaining the temperature of food packs 57 on the top shelf) and through perforations in the sheet 80 which are immediately beneath the fan. The fan 92 forces that air into the compartment 88 and through the outlet 96. The air driven through the outlet 96 and past the fins 97, 98 is forced downwards and slightly inwards by virtue of the inclination of the fins 97, 98. The air entering the compartment 34 through the perforations 38 in the skin 36 has a component of outward movement towards the open front of the chamber 34. The inward direction of flow of the air from outlet 96 and the outward movement of the air from the perforations 38 results in a resultant substantially vertical downwardly moving air curtain 104 across the open front 35 of the chamber 34. Persons requiring a pack 57 of hot food can simply reach through the air curtain 104, pick up a pack of food and then remove the pack from the cabinet 10.

The air forming the air curtain 104 flows downwards towards a collection zone 106 adjacent the perforated front metal sheet 62 where it is joined by air which has flowed over the food packs 57 in the chamber 34. The continued operation of the pump 66 draws the air from the collection zone 106 through the front perforated sheet 62 and into the inlet 68 for recirculation. The shield 64 on the shelf 63 ensures that food packs 57 on the shelf 63 cannot slip forward and cover the perforated sheet 62.

The use of the air curtain 104 helps to retain in the chamber 34 the heated air which passes over the food packs 57 from the duct 41. In that way, heated air is retained in the chamber 34. Also, when a customer reaches through the air curtain, the flowing air 104 forms a seal around the wrist of the customer minimising the escape of air from the chamber 34 as a food pack is being removed.

It will be noted that the perforations 38 in the skin 36 extend for substantially the full length and width of the duct 41. In that way, a good supply of heated air over all the shelves 46, 63 of the cabinet 10 can be achieved keeping the food packs 57 evenly heated throughout the cabinet.

The compartment 86 above the perforated sheet 80 at the top of the compartment 34 serves as a collection zone for heated air which enters the compartment by convection through the perforated sheet 80. Air in the collection zone tends to trickle out back through the perforations and is drawn through the fan 92 with other air from the upper end of the chamber 34. The air which accumulates in the chamber 88 serves to provide a source of heated air for the curtain for a brief period if, for some reason, there is a short interruption of heated air from the duct 41. For example, in order to effect an efficient heat exchange between the air and the heating elements 76, the pump may be programmed to operate so that air is delivered to the heating zone 74 in pulses of, say, 10 seconds duration at intervals of say 3 seconds.

The heating elements 76 can be arranged to heat the air to the desired temperature and a thermostat arrangement may be provided for heat control. The air may be heated to temperatures in the range of 80 to 120 degrees Centigrade.

A display may be provided on or adjacent the top of the front panel 20 if desired.

Reference is now made to Fig 3. In many respects the cabinet shown in Fig 3 is similar to the cabinet described with reference to Figs 1 and 2 and only the differences will be described. In Fig 3, parts corresponding to parts in Figs 1 and 2 carry the same reference numerals.

In Fig 3, the rear wall 16 is formed with an opening 110 which gives access to the rear of the shelves 46 in the chamber. A door 111 is mounted on upper and lower side hinges 112 carried by the rear wall 16 and can be opened and closed to open and close the opening 110.

The door 111 is double skinned. A front skin of the door 111 is formed by a perforated panel 116 and a rear skin is imperforate. A space between the perforated panel 116 and the rear skin defines part 117 of the duct 41 which is open at the top and bottom. The front skin carries baffles which incline downwardly as in Fig 2 but the angle of inclination increases the nearer the baffles are to the top of the perforated panel 116.

A floor 58 extends between an upstanding perforated rear metal sheet 118 and a perforated front metal sheet 120 extending over a collection zone 106. The rear metal sheet 118 extends from one side wall 14 to the other upwardly from the bottom wall 12 and is spaced from the rear wall 16 so as to define an open-topped further part 122 of the duct 41 in alignment with the part 117 of the duct 41 in the door 111. Suitably mounted in the cabinet 10 beneath the floor 58 is an air pump 66 having an inlet 68 and an outlet 70. The inlet 68 is positioned in front of a divider 72 extending between the side walls 14 and between the bottom wall 12 and floor 58. The outlet 70 directs air into a heating zone 74 to the rear of the divider 72. Electrical heating elements 76 are suitable mounted in the heating zone 74.

Looking at the upper end of the cabinet 10, a short double skinned section 124 is mounted on a cross member 126 extending between the side walls 14, the cross member 126 closing the section 124 at its upper end. A perforated metal sheet 127 extends from one side wall 14 to the other and from the cross member 126 to a front cross member 82. A panel 129 of insulating material is also mounted on the underside of the top wall 18. An area between the perforated metal sheet 127 and the plate 129 is divided into two compartments 128, 128a by a metal sheet 130 which carries a fan 92. A baffle 94 extends between the cross member 82 and panel 129 at an angle of approximately 45 degrees and is intended to direct air towards an outlet 96 formed by one or more slots in the metal sheet 80. A guide fin 97 projects downwardly from the sheet 127 adjacent the outlet 96. A portion 132 of the metal sheet 127 between the cross member 78 and the divider sheet 90 is perforated.

A strip light fitting 100 is mounted between the canopy wall 22 and the front cross-member 82 and a front guide fin 134 is provided at the back of the light fitting 100 which is inclined to the vertical to impart an inward movement to the air which passes through the outlet 96 similar to that described with respect to Figs 1 and 2.

The operation of the cabinet shown in Fig 3 will now be described.

With electric power switched on to the pump 66, the heating elements 76 and the fan 92, the pump 68 draws air through the front perforated sheet 120 and into the inlet 68. The air is then blown by the pump 66 through the outlet 70, over the heating elements 76, through the perforated sheet 118 and into the part 122 of duct 41. The heated air is driven upwards through the duct part and into the part 117 of the duct 41 defined in the closed door 111. The heated air is forced through the perforations 38 in the perforated panel.116 forming the front skin of the door 111 and into the chamber 34 as indicated by the arrows A. The baffles 42 help to deflect the heated air downwardly and encourage flow of air around the food packs 57 on the shelves 46. The operation of the fan 92 draws some of the air at the top of the chamber 34 through the perforations in portion 132 of the sheet 128 and into the compartment 127. The fan 92 forces that air into the compartment 128 and through the outlet 96. The air driven through the outlet 96 and past the fin 98 is forced downwards and slightly inwards similar to the cabinet shown in Figs 1 and 2 and as shown by arrows to form an air curtain 104 across the open front 35 of the chamber 34. Persons requiring a pack 57 of hot food can simply reach through the air curtain 104, pick up a pack of food and then remove the pack from the cabinet 10.

The front wall 20 does not carry a see through panel as in Figs 1 and 2 but carries a display panel 108 at its upper end. The operation of the cabinet 10 will now be described.

In order to fill the shelves 46 with food packs 57 and to replenish the shelves without having to do so from the front of the cabinet, the door 111 can be swung

open rearwardly about the hinges 112 and closed again afterwards. An audible and/or visible alarm may be provided to indicate to an operative that the door has been opened. The use of the alarm acts as a reminder to the operative to close the door 111 again.

On opening the door 111 as the door 111 is opened, a switch or switches (not shown) may be operated automatically so as to switch off the supply of electricity to the heating elements 76 and to the pump 66. The parts 117 and 122 of the duct 41 will no longer be in alignment and air pumped in to the part 122 of duct 41 as the pump 66 slows down and the heating elements cool could escape through its open upper end and blow on to an operative. To prevent that a cover 136 may be provided which can be used to cover the upper end of the duct 64 when the door 26 is swung open. Such a cover 136 is shown in Figs 4 and 5. In Fig 5 the cover 136 is shown broken away. The cabinet 10 of Fig 3 is modified by repositioning the hinges 112 on the inside of the cabinet as shown in Fig 5. The cover 136 comprises a rectangular metal sheet fixed to a shaft 137 which is rotatably mounted on spaced apart brackets 138 (one only of which is shown) on the inside of the cabinet 10. The metal sheet forming the cover 136 has a sealing strip 136a along its free edge. An end of the shaft 137 adjacent the lower hinge 112 is drivably connected to a bevel gear 139. The bevel gear 139 which meshes with a bevel gear 140 fixed to a hinge shaft 112a which is drivably connected to the door 111. As the door is moved towards its open position as shown in Fig 5, the bevel gear 140 moves with the door and transmits drive to the shaft 137 so as to move the cover 136 downwardly from the Fig 4 position to the Fig 5 position in which it covers the complete upper end of part 122 of the duct 41. Once the door 111 is closed again, the supply of electricity is switched on again to drive the pump 66 and heat the elements 76. Preferably, the bevel gears 139, 140 will be suitably encased to render them inaccessible to persons taking food packs 57 via the open front of the cabinet 10. The use of the cover 136 also prevents objects accidentally being dropped into the part 122 of the duct 41 when the cabinet 10 is being refilled.

Although a single door 111 is shown, a double door arrangement may be provided so that each door is substantially half the width of the door 111. In such a case, a bevel gear arrangement can be provided adjacent the lower hinge 112 for each door 111.

It should be appreciated that the cabinet shown in Figs 1 and 2 can be modified so as to have an open rear door or doors 112 similar to that shown in Figs 3 or Figs 4 and 5.

As shown in Fig 3, the cabinet 10 may be arranged back-to-back with a refrigeration unit 150 indicated diagrammatically in broken lines and shown partly broken away. As is well known, a refrigeration unit 150 gives off heat extracted from within the refrigerator itself. In the present case, the heat given off is transferred to air in a heat exchanger 152 or other suitable means and ducting 154 is provided to enable to heated air to enter the cabinet 10 upstream of the pump 66. The air from the refrigeration unit 150 supplements or provides the air which is circulated through the cabinet 10. The flow of air from the refrigeration unit 150 can be controlled by a flow controller 156.

CLAIMS

1. A heated food storage and display cabinet comprising an open fronted enclosed chamber in which packs of food can be stored, an upwardly extending enclosed air duct having a plurality of outlets over a substantial length of the duct leading from the duct to the chamber, a first flow inducing means for directing air upwardly through the duct and a second flow inducing means for producing a curtain of air which is directed across the open front of the chamber, and heater means, the first flow inducing means causing the air to pass over the heater means, through the duct passing through the outlets and into the chamber and the second flow inducing means being arranged to draw air from the upper end of the chamber and use it in the formation of an air curtain across the open front of the chamber.

2. A heated food cabinet according to claim 1 in which the upper end of the duct is closed to encourage air to flow through the outlets and into the chamber.

3. A heated food cabinet according to claim 1 or 2 in which an air collection zone is provided at the upper end of the chamber in which air can.

4. A heated food cabinet according to claim 1, 2 or 3 in which the duct is preferably arranged to a rear of the chamber.

5. A heated food cabinet according to any preceding claim in which the air directed across the front of the chamber is directed towards a collection zone for recirculation.

6. A heated food cabinet according to claim 5 in which the collection zone comprises a recirculation inlet at a bottom of the chamber.

7. A heated food cabinet according to claim 5 in which a shield is provided for preventing food packs in the chamber from blocking the recirculation inlet.

8. A heated food cabinet according to claim 7 in which the shield is provided on a shelf positioned at the lower end of the chamber.

9. A heated food cabinet according to any preceding claim in which the heater means is arranged in a base or lower part of the cabinet.

10. A heated food cabinet according to claim 9 in which the heater means is arranged immediately upstream of the duct.

11. A heated food cabinet according to any preceding claim in which the first flow inducing means may be arranged in a base or lower part of the cabinet.

12. A heated food cabinet according to any preceding claim in which the first flow inducing means is arranged upstream of the heater means.

13. A heated food cabinet according to any preceding claim in which the duct is partly defined by a perforated wall, the perforations forming the said outlets.

14. A heated food cabinet according to claim 13 in which the perforated wall defines a closure wall of the chamber.

15. A heated food cabinet according to any preceding claim in which deflection means such as one or more baffles are provided for controlling flow of air from the outlets into the chamber.

16. A heated food cabinet according to any preceding claim in which the cabinet has an openable door to enable food to be placed in the cabinet initially and to enable staff to refill the cabinet.

17. A heated food cabinet according to claim 16 in which at least part of the said duct is be arranged in the door

18. A heated food storage and display cabinet comprising an open fronted enclosed chamber in which packs of food can be stored, an upwardly extending

enclosed air duct having a plurality of outlets over a substantial length of the duct leading from the duct to the chamber, a first flow inducing means for directing air upwardly through the duct and a second flow inducing means for producing a curtain of air which is directed across the open front of the chamber and heater means, the first flow inducing means causing the air to pass over the heater means, through the duct, through the outlets and into the chamber, the cabinet having an openable door in which at least part of the said duct is defined, the openable door enabling food packs to be placed in the cabinet other than through the open front.

19. A heated food cabinet according to claim 17 or 18 in which a wall of the cabinet which has the openable door therein defines part of the duct.

20. A heated food cabinet according to claim 19 in which a cover is provided for blocking an exposed part of the duct in the wall when the door is open so that air does not blow from the exposed part of the duct on to a person refilling the cabinet.

21. A heated food cabinet according to claim 20 in which the cover is arranged to block the duct automatically preferably by transmission means such as gearing.

23 A heated food cabinet according to claim 20 or 21 in which the cover is pivotally mounted for rotational movement from an open to a close position as the door is opened.

23. A heated food cabinet according to claim 20, 21 or 22 in which means is provided for switching of the heating means and/or the first flow inducing means when the door is open, the switch means preferably operating automatically as the door is opened.

24. A heated food cabinet according to any of claims 16 to 23 in which an audible/visual warning may be provided when the door is opened to remind the staff to close the door after refilling the cabinet.

25. A heated food cabinet according to any preceding claim in which duct means is provided for ducting the air to the chamber from means for pre-heating the air.

26. A heated food cabinet according to claim 25 in which a refrigeration unit is arranged adjacent the cabinet, means being provided for directing warm air created by the refrigeration unit into the cabinet through the duct means to be heated further by the heater means.

27. A method of storing and displaying heated food in an open fronted cabinet which is closed at its rear end and in which packs of the food can be stored, the method comprising providing an upwardly extending enclosed air duct in the cabinet, inducing a flow of heated air upwardly through the duct and into the chamber through outlets provided over substantially the full length of the duct so as to flow over packs of the heated food and producing a curtain of heated air which is directed across the open front of the chamber, the curtain of air comprising air drawn from the upper end of the chamber.

28. A method according to claim 27 having steps which utilise the features of any of claims 1 to 15.

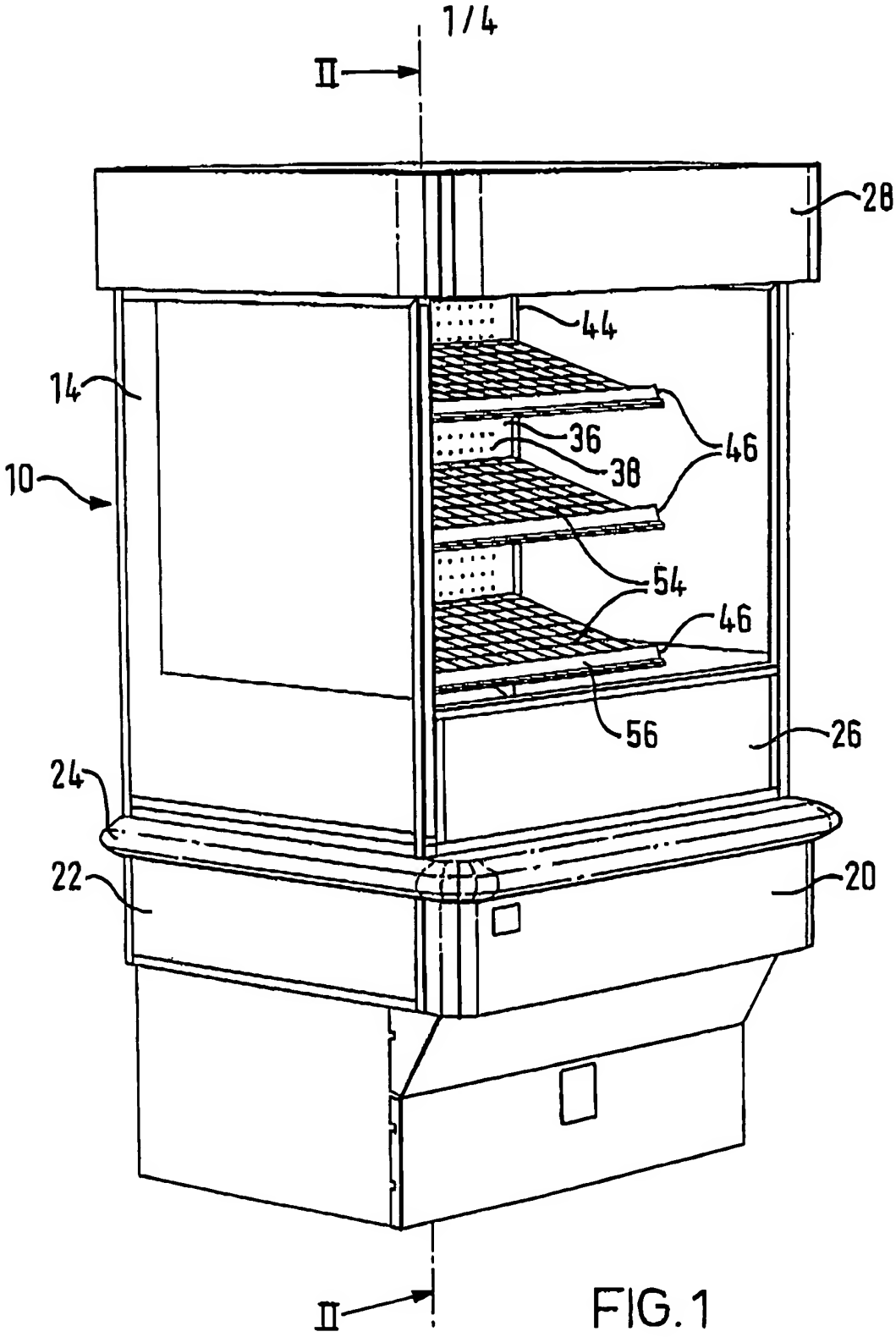

FIG.1

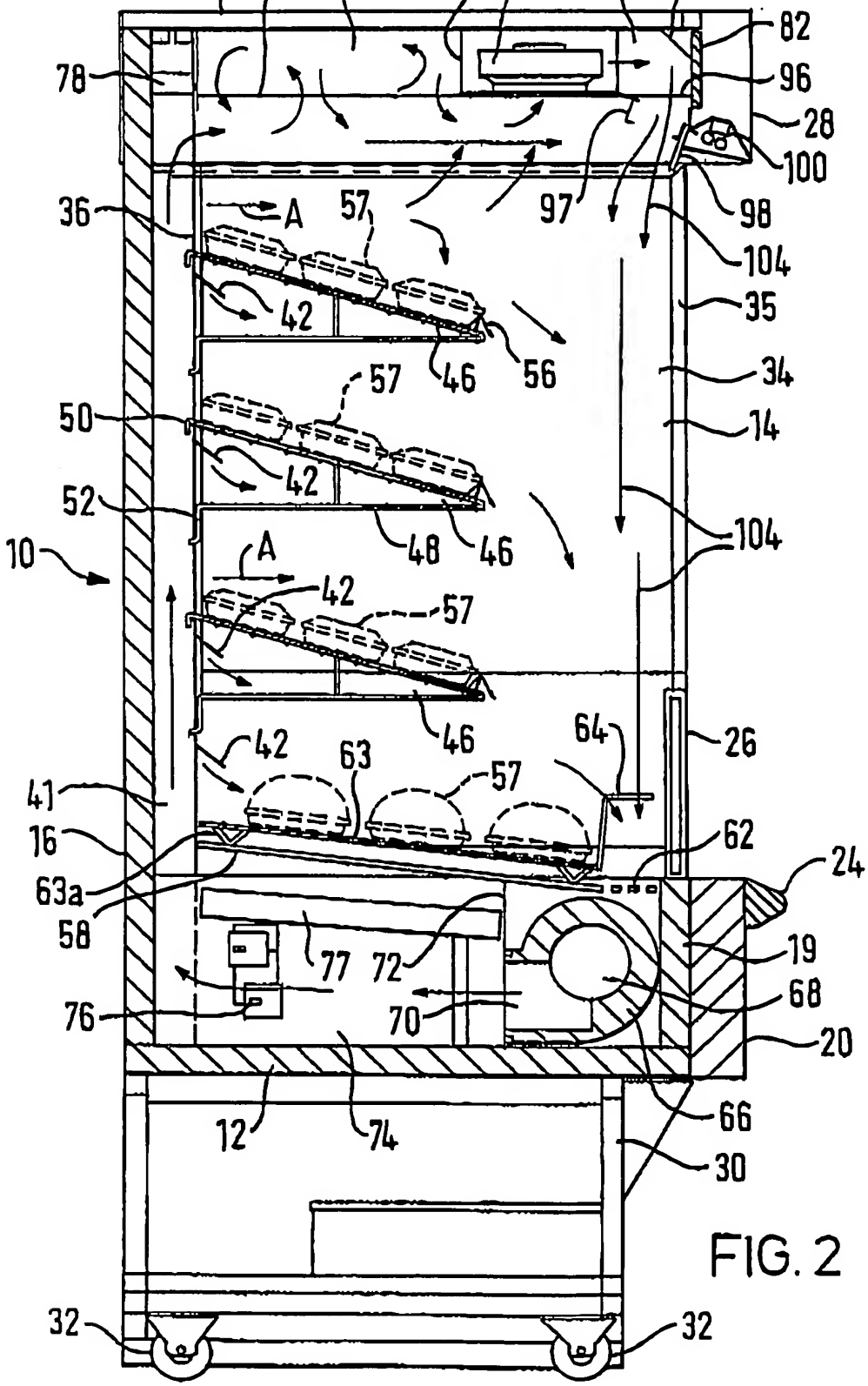
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FIG. 2

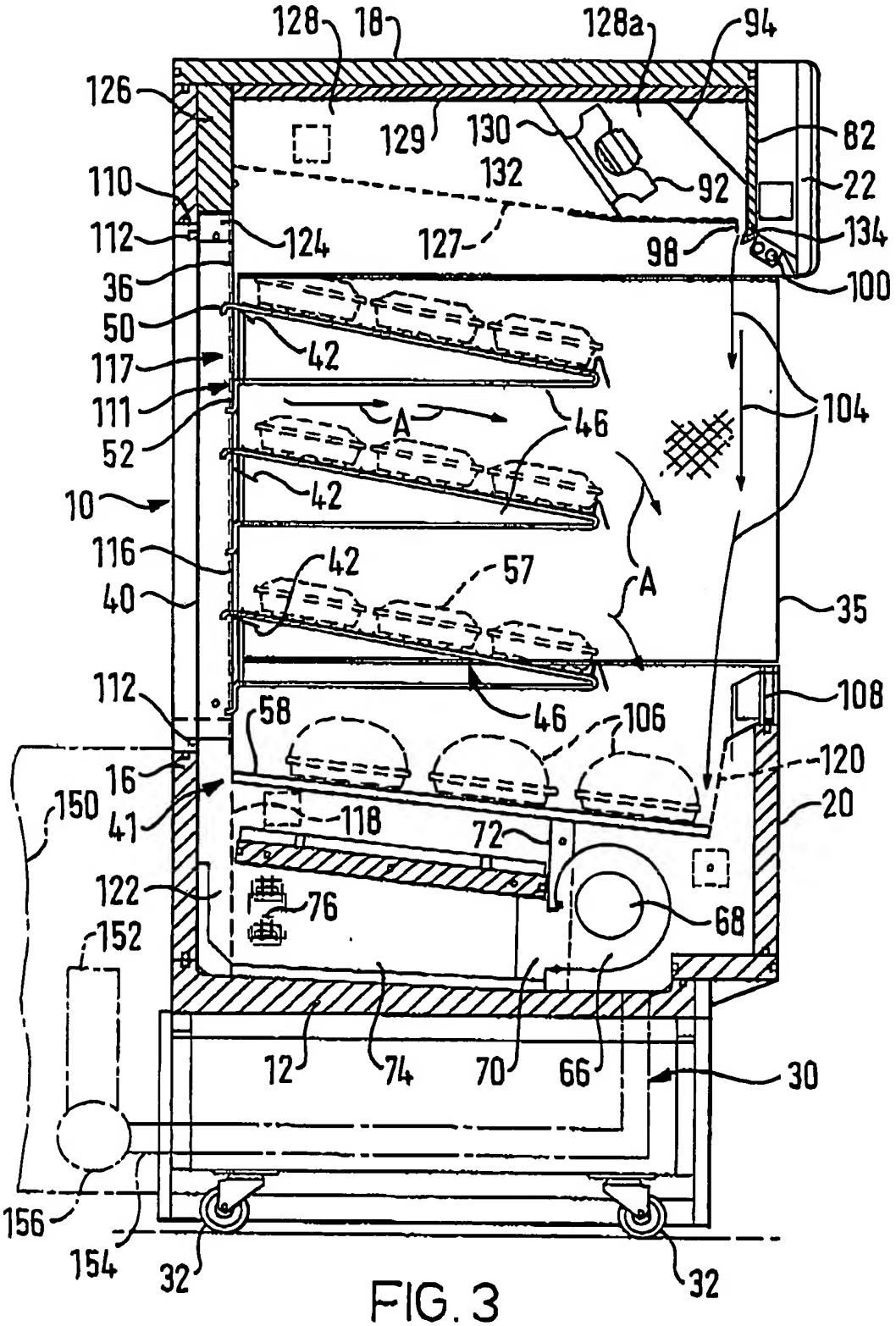
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FIG. 3

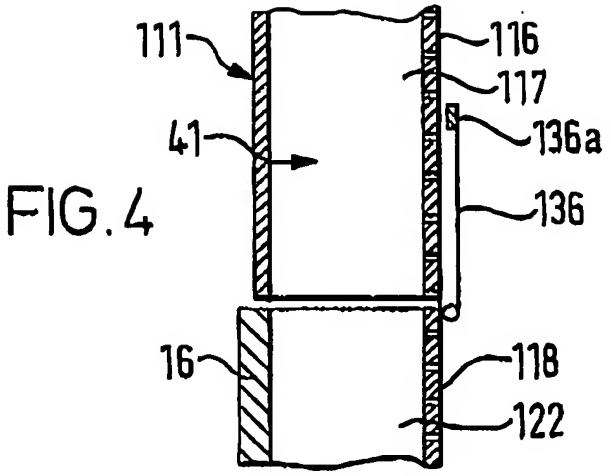
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FIG. 4

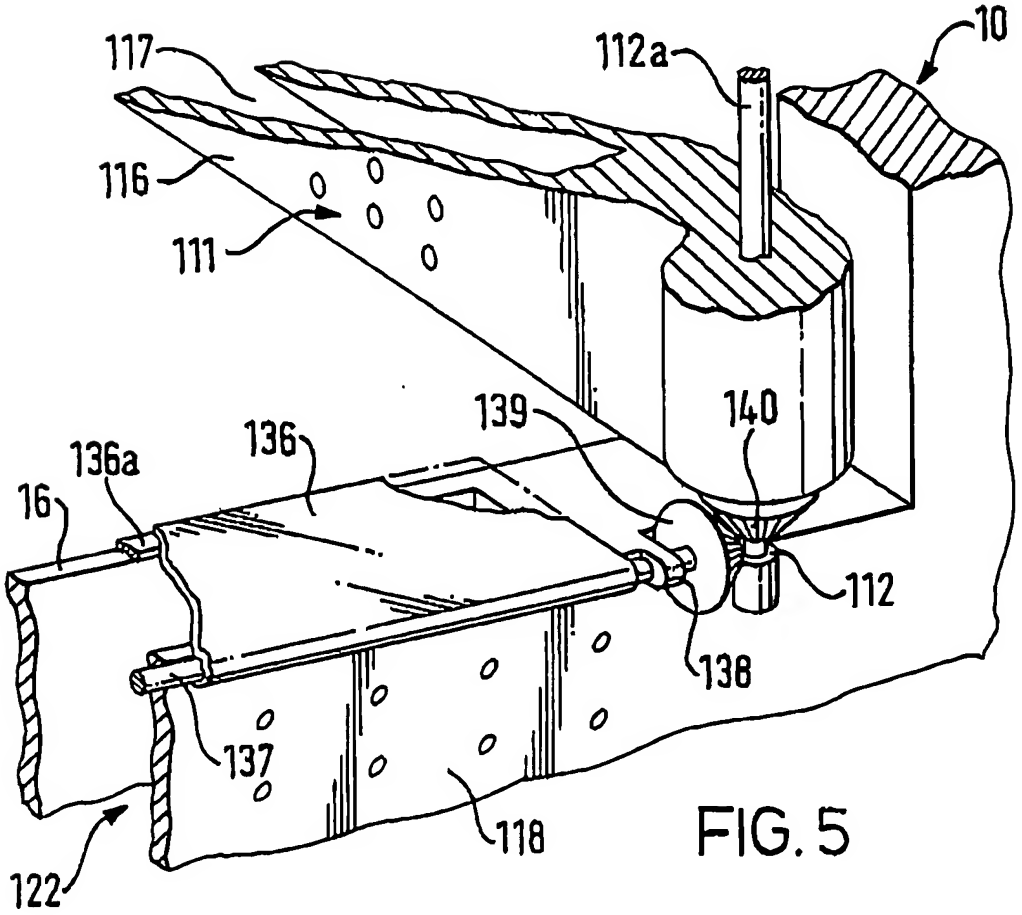
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FIG. 5

INTERNATIONAL SEARCH REPORT

Inter nal Application No
PCT/GB 99/04379

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A47J39/00 A47F3/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A47J A47F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 089 322 A (GUIBERT RAUL) 16 May 1978 (1978-05-16) the whole document	1,3-6, 9-11,13, 14,27,28
A	GB 1 207 726 A (THOMAS COLLINS & CO. LTD) 7 October 1970 (1970-10-07) the whole document	1
A	US 4 478 047 A (IBRAHIM FAYEZ F) 23 October 1984 (1984-10-23) the whole document	16-18
A	FR 2 346 989 A (ALLEGRUCCI ET CIE) 4 November 1977 (1977-11-04) the whole document	16

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 April 2000	26/04/2000
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016	Authorized officer Lupo, A

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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PCT/GB 99/04379

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